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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PS 3037 for a patent by THE COMMONWEALTH OF AUSTRALIA as filed on 20 June 2002.

I further certify that the above application is now proceeding in the name of METAL STORM LIMITED pursuant to the provisions of Section 113 of the Patents Act 1990.

WITNESS my hand this
Third day of July 2003

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
AND SALES

~~THE COMMONWEALTH OF AUSTRALIA~~
Mdal Steam Limited



AUSTRALIA
PATENTS ACT 1990

PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED:

"A CARTRIDGE ASSEMBLY FOR MULTIPLE PROJECTILES"

This invention is described in the following statement:

This invention relates to cartridges for firearms in particular to those cartridges that contain multiple projectiles for sequential ejection from the cartridge.

BACKGROUND

There exists a generally preferable need to launch projectiles at high velocity from firearms. High velocity at the end of the barrel of the firearm means that whatever the weight and dimensions of the projectile, a sufficiently large gaseous expansion event has been provided behind the projectile to eject the projectile at the velocity measured.

In addition to the above well known need is the strategic and actual advantage of firing a multitude of projectiles at about the same time in the same direction. Use of a firearm having such characteristics can satisfy some of the many military needs associated with direct and indirect fire weapons and firearms usage in offensive and defensive environments.

This specification discloses an arrangement that seeks to provide a cartridge, from which multiple projectiles can be fired at a rapid rate, one after the other, at high velocity useable in a variety of firearms ranging from hand-held small calibre to large calibre weapons.

In particular it discloses an arrangement for a cartridge containing multiple projectiles and each projectile having an associated propellant charge that can be individually initiated in a predetermined timing arrangement to eject the associated projectile into the barrel of a firearm at velocities that are useful in required circumstances.

BREIF DESCRIPTION OF THE INVENTION

In a very broad aspect of the invention a cartridge assembly comprises a unitary support body, the support body has a central longitudinal channel housing two or more projectiles in abutting end to end orientation. The support body also has two or more circumferential chambers located adjacent a respective projectile. Each chamber

houses a propellant charge and the support body further has two or more apertures for communicating the products of a gaseous expansion of said propellant from a respective chamber into said central longitudinal channel. The communicated products of gaseous expansion from a circumferential chamber thus force a respective projectile from the cartridge assembly.

In a further aspect of the invention the outer shape of the support body of the cartridge assembly is cylindrical.

In a yet further aspect of the invention the support body has transverse annular walls forming two sides of said circumferential chambers, and the inward wall, which is otherwise a barrier between the inside of a chamber and the central longitudinal channel, has the two or more apertures therein. The radially outward opening of the circumferential chambers are closed off to atmosphere by a cylindrical cover arranged about the outer periphery of the substantially cylindrical support body. The cover is adapted to form a containment barrier, in use, to the products of gaseous expansion of propellant, leaving the only path of escape from the chamber being through the two or more apertures in the wall between the chamber and the central longitudinal channel.

Specific embodiments of the invention will now be described in some further detail with reference to and as illustrated in the accompanying figures. These embodiments are illustrative, and not meant to be restrictive of the scope of the invention. Suggestions and descriptions of other embodiments may be included within the scope of the invention but they may not be illustrated in the accompanying figures or alternatively features of the invention may be shown in the figures but not described in the specification.

BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 depicts a cross-sectional view of an embodiment of a cartridge assembly containing projectiles and propellant;

Fig. 2 depicts a partial cut-away and phantom view of a cartridge assembly containing three projectiles; and

Fig. 3 depicts a perspective view of the exterior of a jacketed cartridge assembly.

## A DETAILED EMBODIMENT OF THE INVENTION

It is anticipated that a cartridge assembly according to the invention can be made of dimensions to suit almost any size of projectile suitable for firing through a suitably proportioned barrel of a firearm. That is, projectiles of .22 calibre or projectiles referred to as a 80mm rounds can be accommodated in a cartridge assembly by suitably scaling the relevant elements of the invention. Clearly the cartridge feed mechanisms of respective firearms will need modification to accommodate the generally longer, radially larger and heavier cartridges.

The calibre of firearms and projectiles is expressed in various ways. Cannons are often designated by the weight of a solid spherical shot that will fit the bore, eg. a 12-pounder. Pieces of ordnance that project a shell or hollow shot are designated by the diameter of their bore, eg, a 12 inch mortar or a 14 inch shell gun. Small arms are designated by hundredths of an inch expressed decimally; as, a rifle of .44 inch calibre. In other examples the outer diameter of the projectile or the inner diameter of the barrel of the firearm is referred to in millimetres or thousandths of an inch.

Fig. 1 shows a cross-sectional view of a longitudinal aspect of one embodiment of the cartridge. This view shows a support body 10, which is made preferably of metal. The body may be of any suitable material that can maintain rigidity under the influence of forces related to the rapid expansion of gases associated with the ignition of propellant 12. Those gases are communicated from the sealed chamber 14 into the central longitudinal channel 16 via a plurality of apertures 18. Three projectiles 20, 22 and 24 are located in head to tail orientation within the central longitudinal channel 16 each projectile being located adjacent a respective chamber ie. projectile 20 adjacent chamber 14a, projectile 22 adjacent chamber 14b and projectile 24 adjacent chamber 14c.

The projectiles are, as stated, located head to tail. Such an arrangement keeps the length of the cartridge to a minimum. Assistance in keeping them coaxially aligned within the central channel of the support body so that they will be ready for firing into the also coaxially aligned barrel is not a necessity . Thus it is merely preferable that this alignment be maintained during transport and storage and up to its time of firing. To provide an alignment means a small concave indent 15 is provided on the rear surface of each projectile into which the apex of the head of the projectile is located in abutting relation. Yet further means of alignment can be provided by a burster disc enclosing the entire nose of the projectile or an annular stabilising ring 15a located on the outer surface of the projectile forward of its middle and abutting the inner surface of the central channel (the latter being shown in Fig 1).

In Fig. 1 there is also displayed a trailing hollow frusto-conical shaped tail portion 20a which does not touch the outer surface of the following projectile and is provided for minimising turbulence and stabilisation during flight of the projectile.

In this embodiment a cylindrical sleeve 26 forms the radially outermost wall of the chambers 14a, 14b and 14c. The sleeve is made of metal and is suitable for mechanical fixing to the support body fore and aft of each the chambers.

Fig. 1 illustrates one way in which the sleeve can be adapted to both firmly encapsulate the support body 10 and to serve as a chamber-forming element. The metal of the sleeve 26 forms the outer wall of the chamber space 14a. To provide a gas tight seal, referred to as the primary seal of the arrangement as will be discussed later, the sleeve 26 is crimped into annular grooves 28 and 30 which are provided in the radially outermost surface of the annular walls fore 32 and aft 34 of the chamber. The crimping technique is ideally used, fore and aft of each of the chambers 14a, 14b and 14c. However, it is likely that a single crimp between chambers will suffice. This may be because the cartridge itself, during use in a firearm, is surrounded by a breech or similar (not shown).

The breech will be specifically shaped and constructed so as to steady the cartridge during firing. The breech will also envelope the cylindrical walls of the cartridge assembly and assist the sleeve to resist the outward movement, particularly at the seals, that they will experience as a result of the rapid expansion of gases after ignition of the propellant in the chamber thus formed.

In another embodiment, not depicted, the same metal as the support body 10 forms the cylindrical outer wall of the cartridge assembly. Access to the chambers for placement of the propellant is dependent on the type of propellant to be used in the cartridge. It may be possible to provide a sealable aperture through which the propellant can be inserted into the chamber along with a suitable ignition means.

As yet the ignition means has not been described since it is a matter of choice dependent again on the propellant to be used in the cartridge assembly. Clearly different types of propellant will be chosen on the basis of a number of requirements, not the least being the forces desired to be generated by their ignition that will consequently eject a projectile at a desired velocity. Other considerations include the volatility of the propellant for the conditions of use of the cartridge including storage and transportation. Yet another requirement will be its form (liquid, gas, gel or powder) and whether it is suitable for the process of encasement in the chamber. Electrical control of ignition is possible in a variety of ways known in the art, such that as an example, all of the projectiles are ejected within a predetermined interval determined by the timing of the ignition signals sent by the control apparatus.

In experimental cartridge arrangements commercially available gun propellant is encased in metal foil having an annular form to fit snugly within the annular chambers provided. Such propellant has been chosen because of its ready availability and the need to determine maximum projectile velocities. Further it was chosen to minimise the effect of premature ignition by gases that may blow back from an ignition associated with the ejection of a forwardly located projectile even assuming the encasement method should not resist the blow-back pressure and temperatures.

The encasement method of the propellant during the life of a cartridge assembly up till use is important. If it is to be anticipated that the cartridge assembly will be stored in uncontrolled environments such as high humidity and the propellant has hydrophilic properties that may render the propellant inoperative at the moment of required ignition, it is important to appropriately seal the propellant.

In most circumstances the propellant encasement method will require the propellant to burn through the encasement material and as such the effect of blow back pressures and even those gasses having accompanying high temperatures will be insufficient to prematurely ignite the encased propellant.

Some of the apertures provided in the radially innermost wall of the chamber are shown in cross-section in Fig. 1 but as illustrated in Fig. 2 they are arrayed about the whole of the cylindrical wall in a grid like fashion. It is anticipated that some variation of the grid may be advantageous in not only its spacing and configuration but also in their number and angle through the wall.

The exit of the apertures into the central channel is located, in this embodiment, about the rear portion of a respective projectile.

After the propellant is ignited the gases produced initially expand in all directions testing the sealing of the outer wall of the chamber. Those seals are the primary seal resisting the massive expansionary forces of the gases produced by the combustion of the propellant initially and during the complete process of combustion. Even when the chamber is formed in the wall of the cartridge assembly body, that chamber is the primary location for that resistance.

Rapidly expanding gasses will tend to move and take a path of least resistance and the apertures 18 provide such a path.

Initially the velocity of the gases escaping from the apertures will be less than will exist shortly thereafter once the propellant reaches its maximum combustion state. It

is during the initial phase of the process that the projectile associated, in positional terms, with the apertures from which the gases are escaping will begin its forward movement out of the cartridge and into the barrel of the firearm. The velocity of the gases escaping into the central chamber through the apertures is less initially and reaches a maximum near the peak expansive phase of the propellant combustion.

As the projectile moves forward it leaves a larger volume behind it and into that larger volume and its associated lesser pressure will quickly follow the gases expanding out of the chamber via the apertures. The projectile is thus moved at an increasing rate out of the cartridge reaching maximum velocity somewhere along the barrel before exiting and being immediately affected by the external atmosphere during its now directed trajectory.

The rearward forces associated with gaseous expansion that moves rearward along the central channel of the cartridge are relevantly less than those associated with the forces experienced within the chamber but nonetheless are in existence.

In some way the ring 15a provides resistance to the passage rearward of the gasses but in any event the location of and the encasement of the nearest propellant is such that any gasses that do pass the projectile will not prematurely initiate the propellant associated with that projectile.

The rear of the cartridge shows a screw threaded cap 36 for providing a rear wall for the central channel that forms the rear most volume for the gasses to enter prior to ejecting the last projectile.

Fig. 2 depicts a partial breakaway view of a cartridge assembly showing the features of the chamber and associated apertures along with the external shape and configuration of the sleeve that encases the cartridge. Like features are identified by like numerals to those associated with Fig. 1 as is also the case for Fig.3 which depicts a fully encased cartridge.

Sabot technology it is anticipated will provide for increased velocities of projectiles.

It will be appreciated by those skilled in the art, that the invention is not restricted in its use to the particular application described. Neither is the present invention restricted in its preferred embodiment with regard to the particular elements and/or features described or depicted herein. It will be appreciated that various modifications can be made without departing from the principles of the invention. Therefore, the invention should be understood to include all such modifications within its scope.

Dated this 20th day of June 2002

~~THE COMMONWEALTH OF AUSTRALIA~~ Metal Storm Limited
By its Patent Attorneys
MADDERNS

AUSTRALIAN PATENT OFFICE SEC 113

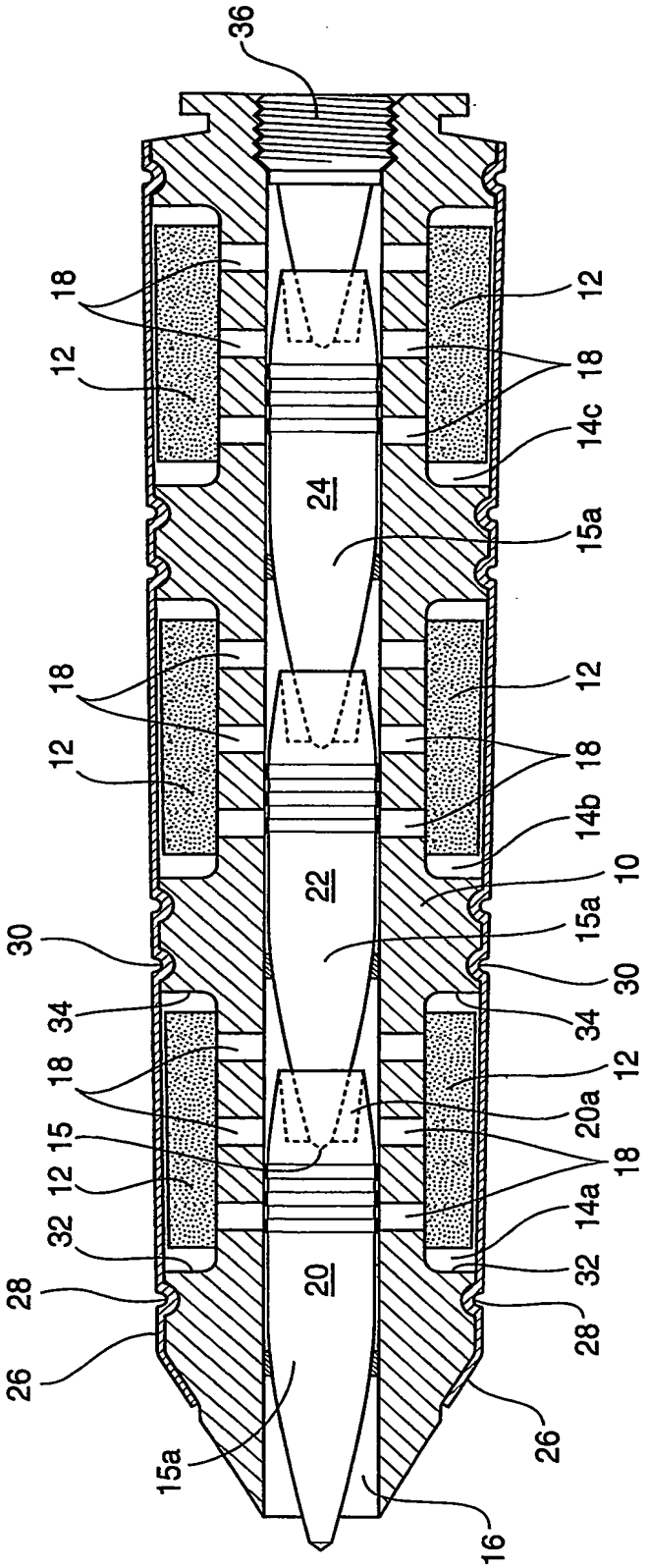
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Fig 1

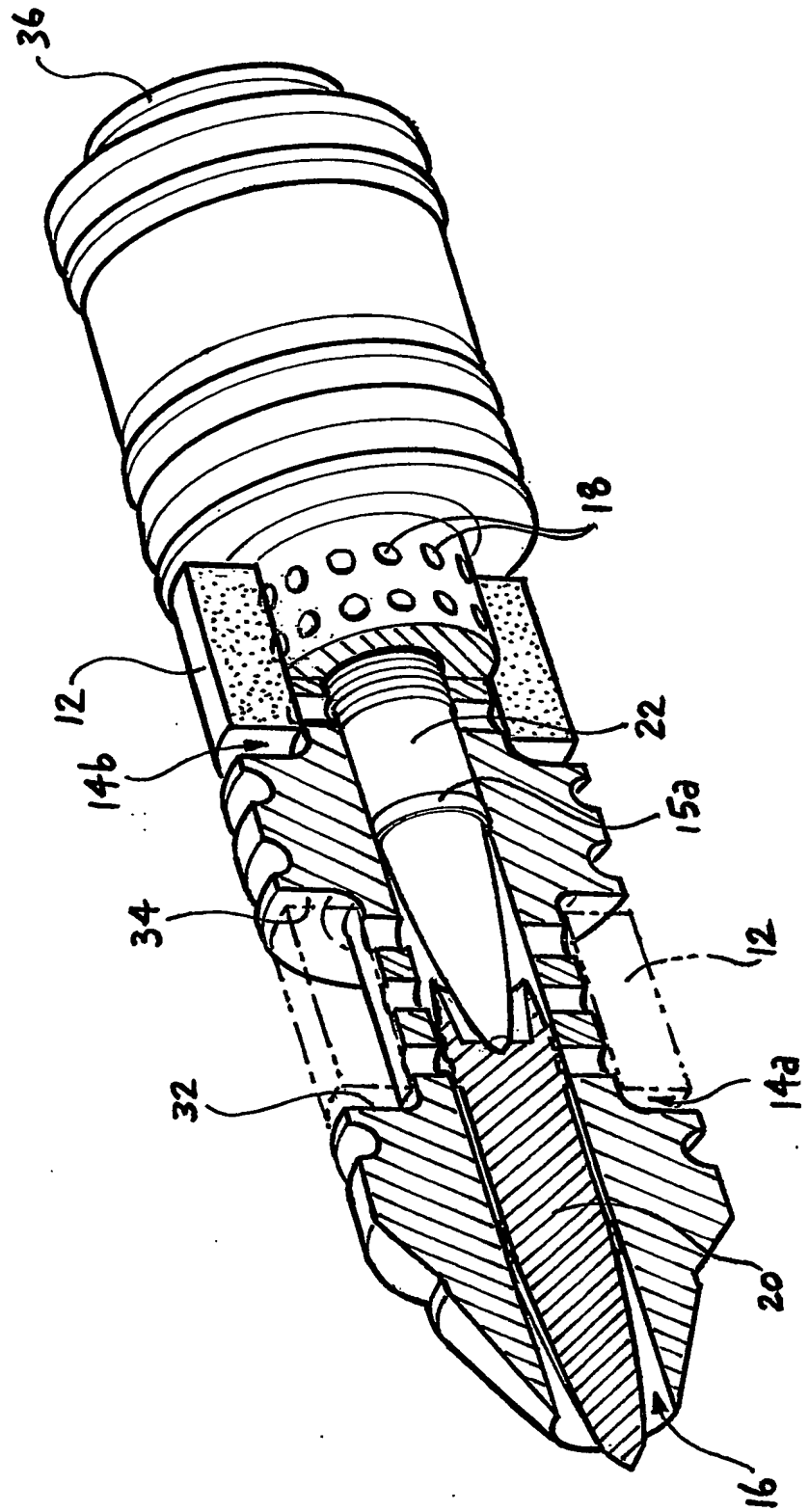


Fig 2

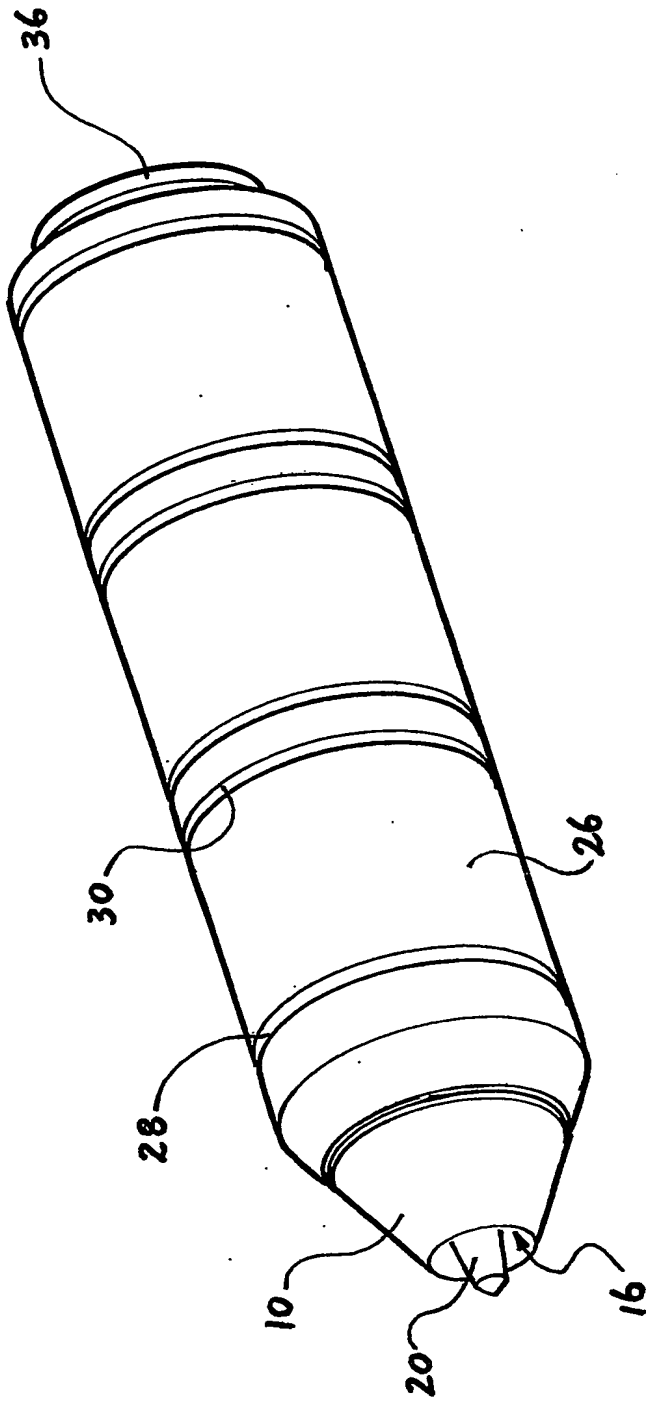


Fig 3